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FOREST PEST MANAGEMENT
Pacific Southwest Region

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EVALUATION OF PEST CONDITIONS IN FOUR CAMPGROUNDS, WARNER MOUNTAIN RANGER DISTRICT, MODOC NATIONAL FOREST

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ABSTRACT

Blue Lake, Mill Creek, Cedar Pass and Plum Valley campgrounds were evaluated for pest conditions. Overstocking and bark beetle attacks were common in, or around, all four campgrounds. Disease situations discussed include black stain root disease and annosus root rot at Blue Lake Campground, and dwarf mistletoe and annosus root rot at Cedar Pass Campground.

INTRODUCTION

The Modoc National Forest requested evaluations of four campgrounds on the Warner Mountain Ranger District for input to vegetation management plans. Dave Schultz and James Allison examined Blue Lake campground on August 19, 1983 and Mill Creek, Cedar Pass and Plum Creek campgrounds on August 20.

BLUE LAKE
OBSERVATIONS AND DISCUSSION

Blue Lake campground is located on the east shore of Blue Lake in the southern end of the Warner Mountains. The north half of the campground has a mixture of ponderosa pine and white fir. In spite of numerous trees removed in the past, stocking is generally heavy and ranges up to 300 sq. ft./a. basal area. The south half of the campground has a fairly open stand of ponderosa pine with a few Jeffrey pine, juniper and mountain mahogany. Pocket gophers, Thomomys bottae, are limiting regeneration in some areas.

Several ponderosa pine in the campground were attacked by mountain pine beetle during 1983. The trees had been predisposed to bark beetle attack by black stain root disease, caused by Ceratocystis wageneri. This same combination of pests is also responsible for many of the stand openings in the campground. There is evidence of black stain root disease infection centers throughout the campground area.

Areas with above ground symptoms of this disease were mapped, although this does not indicate the total extent of the problem. Local spread in an infection center occurs through root contacts of hosts. The only host species at Blue Lake campground are ponderosa and Jeffrey pines. Infections spread from roots through the sapwood of the root system, root crown and lower bole. The fungus plugs the vascular system which causes crown decline and predisposes the tree to bark beetle attack.

Research has shown the fungus can be present in ponderosa pine roots 50 to 70 feet away from trees with the nearest above ground symptoms. Ceratocystis wageneri does not decay wood but rather tends to die out of the root system within a few years after the host dies. In some circumstances it is possible to control the disease by cutting all hosts in a 75 foot wide zone beyond the visible boundaries of an infection center. The control area can be immediately replanted with non-host species. If the area can be kept free of hosts, the fungus will die out of the root systems within five years and host species could be replanted. Because the disease is so widespread in the campground, cutting a 75-foot host-free buffer would result in the removal of virtually all pines in the campground. The aesthetic impact of a control project could be reduced by treating part of the campground at a time, although this would considerably increase the length of time of the project.

Annosus root rot, caused by Fomes annosus, is also present in the campground. Ten infection centers in pine and one infection center in fir are scattered in or adjacent to the campground. Annosus root rot can kill pines or predispose them to bark beetle attack by killing the cambium of the roots and eventually girdling the tree at the root crown. In true firs it usually acts as a root and butt rot which can make trees hazardous, although it is capable of killing small trees. The fungus can act as a saprophyte in dead root systems and persist until the wood is completely decayed. Short distance spread is by root contact with an infected tree or stump. Infections in pine can spread to any species of conifer, whereas infections in fir appear to be limited to fir. Long distance infections in pine occur when spores infect freshly cut stump surfaces. Fir stumps can also be infected by spores, however, living fir trees can become infected through basal wounds on fire scars. The use of borax or freshly cut conifer stumps will prevent infection by Fomes annosus. Treatment of freshly cut conifer stumps in recreation areas is required by FSM 2331.33 R-5 Supplement No. 90.

If the one annosus root disease center in fir near site 16 was revegetated with pine, the probability is very low that the pine would become infected by F. annosus. Pine planted in this site would, however, become infected with black stain root disease from the centers that surround it. White fir planted at site 16 would not be affected by black stain. Planted fir seedlings which contact roots infected with F.

annosus at a young age would probably be killed. White fir seedlings which escape infection until they develop a substantial root system would not be killed immediately, but would develop root and butt rot from F. annosus. The fir would probably survive if silvicultural measures maintained growth at a rate rapid enough to add roots and wood faster than the decay advanced. Hardwoods would not be affected by annosus or black stain root diseases, but the only local species that have a tree-like form are aspen and mountain mahogany.

All conifer species planted in or near the annosus root disease centers in pine will become infected and die. The centers will expand by root contact until they reach a physical barrier such as a creek, or an area which does not have conifer roots. Based on the stumps present at Blue Lake campground, root systems will remain as sources of infection for at least several decades. Hardwoods or brush will be able to survive in the annosus root disease centers.

MANAGEMENT ALTERNATIVES

1. Do Nothing. Black stain root disease centers will expand and kill pines. White fir, juniper and hardwoods existing in black stain centers will not be affected by the disease. As centers expand and the disease dies out of the middle, pine may seed in and survive, if it is not killed by gophers. Annosus root disease centers in pine will expand and kill all species of conifers. The disease will persist in infected root systems and stumps for decades. Natural conifer regeneration or planted seedlings whose roots contact infected root systems will become infected and die. Only hardwoods, brush, grass and forbs will survive in the annosus root disease centers.

2. Move the campground. Black stain and annosus root diseases are already present outside the immediate campground boundaries, along the access road and at the boat launch. There is a high level of tree mortality in the Blue Lake basin. Although the cause of mortality around the lake was not examined in detail, the pattern suggests that root diseases are involved. Moving the campground to another location on Blue Lake would probably not avoid the existing problems and could create some new problems.

3. Control annosus root rot. The infection center in white fir near site 16 could be replanted with white fir. Some seedlings which become infected at a young age will be killed. Those which escape infection until substantial root systems develop should survive if rapid growth can be maintained. If growth slows down in the future, the white fir could become hazardous. The disease could be avoided at site 16 as well as in the centers in pine by revegetating them with hardwoods, brush, grass or forbs. Conifers could be planted in the infection centers after the root systems are so throughly decayed that they will no longer support the growth of Fomes annosus. New infections can be prevented by applying borax to all freshly cut stump surfaces in recreation areas.

4. Control black stain root disease. Black stain root disease could be controlled by cutting all pines in a 75-foot-wide zone beyond the last signs of infection in a center. Non-hosts such as white fir, juniper and hardwoods can be left in the center. The control project could be done in stages, although this would increase the total length of the project. The current pattern of the disease in the campground indicates that the campground roads are too narrow to be barriers to spread of the disease. Control units would have to be laid out on the basis of tree aggregations and disease location rather than campground loops. Pines could be replanted after the disease dies out of the roots in several to five years.

5. Thin campground. The campground is a site 80 Meyer. Normal stocking at age 90 is 198 sq.ft./ac. and desired stocking is 144 sq.ft./ac. The stocking levels in the north end of the campground range up to 300 sq.ft./ac. and tree vigor and growth are undoubtedly declining. Thinning around trees which are not root disease hosts will decrease their chances of being killed by insects and will accelerate their rate of growth. Thinning could slow the rate of spread of root diseases by increasing the distance the fungi must travel along roots before finally girdling a host tree. Thinning would not be an effective control for the root diseases present in the campground unless the spacing of host trees was wide enough to prevent root contact.

MILL CREEK CAMPGROUND
OBSERVATIONS AND DISCUSSION

Mill Creek Campground consists of 20 individual camp sites and a multiple vehicle parking pad for use as a trailhead to the South Warner Wilderness. The campground elevation is 5,750 feet.

The campground is in an all-aged stand of ponderosa pine and white fir. There is good natural ponderosa pine and white fir reproduction. The understory also contains some mountain mahogany, a single juniper, Ribes and Klamath plum.

The only current pest problem observed was several ponderosa pines which had been killed by mountain pine beetle. No signs of diseases were observed. The trees were probably predisposed to bark beetle attack by the stocking levels, which are up to 400 sq.ft./ac in places. Although the campground is a fairly good site, the current stocking is at least twice the desired level. The high level of stocking is probably also partially responsible for the condition of some of the older trees in the campground. A few of these older, dominant white fir and ponderosa pine are showing signs of decadence such as spike tops, dead limbs and thin foliage.

The natural course of events in the campground would be for the basal area to increase with time which would increase the stress on trees. At some point the stress from overstocking, possibly in combination with other stresses such as drought, would make the trees susceptible to bark beetle attack. Bark beetles would lower the basal area, but the trees they select to remove would probably not be compatible with campground

management objectives. The older dominants would probably be among the first trees to be attacked by bark beetles and pine mortality is likely to involve small group kills.

Thinning would lower the probability of mortality caused by bark beetles and could be used to guide the vegetation to meet management objectives. Aggregations of young trees could be thinned to promote vigor and the development of large crowns and root systems which would be desirable in campground situations. The lifespan of some of the older dominants could probably be extended by severely thinning the younger trees surrounding them, although in some situations it may be more advantageous to remove a decadent tree to release a few selected younger replacements. Conifer stumps created during thinning should be treated with borax as specified in FSM 2331.33 R-5 Supplement No. 90 to prevent infection by Fomes annosus. Green pine slash or logs over 3 inches diameter should not be piled or allowed to remain in the campground for more than about a month after cutting to prevent the local buildup of pine engravers, Ips spp. Slash could be hauled away from the campground, chipped, or scorched while green to prevent breeding by pine engravers.

MANAGEMENT ALTERNATIVES

1. Do Nothing. The basal area in the campground will continue to increase with time. Trees will become increasingly susceptible to attack by bark beetles. Mortality caused by bark beetles may involve small groups of trees. The mixture of age classes, sizes and species of trees in the campground should result in a limited amount of mortality at any one time. Mortality will reduce the basal area and release some of the survivors for a period. The campground should remain generally forested for the forseeable future although there will be no control over its appearance or health and periodic removals of dead trees will be necessary.

2. Thin campground. Thinning offers a method of exercising some control over the appearance and distribution of the campground vegetation. If one of the management objectives is to retain a few of the older dominants as specimen or character trees, it would be appropriate to severely thin younger trees surrounding them to extend their lifespan. However, if the objective is to maintain a reasonable mixture of tree sizes regardless of their actual ages, there would be advantages to removing some of the declining dominants to favor younger replacements. Young trees would probably show a greater response to thinning, their useful lifespan in the campground would be longer and they would have lower probabilities of becoming centers of bark beetle group kills than older declining trees. Thinning sapling and pole size aggregations would decrease their susceptibility to bark beetle attack and would promote the development of full crowns and root systems. A thinning has the potential to generate greater revenue than periodic salvage sales, depending on the size and form of the trees. The cost of planning and administering a single thinning could be less than the sum of the effort spent on multiple entries for dead tree removal.

CEDAR PASS CAMPGROUND
OBSERVATIONS AND DISCUSSION

Cedar Pass Campground is located adjacent to State Highway 299 about one mile west of Cedar Pass. The campground is near the interface of juniper woodland and pine-fir forest. Thomas Creek flows through both loops of the campground.

Tree cover in the campground is mostly white fir with some sawtimber-size ponderosa pine and scattered western juniper. White fir reproduction is present in both loops. Openings in the campground generally contain grass and forbs. Willow, cottonwood and choke cherry occur in a riparian zone adjacent to the creek. The campground loops are separated by an opening containing sagebrush, rabbitbrush and a few mountain mahogany and juniper.

All pest problems noted in the campground were on white fir. Overstory white fir were severely infected with dwarf mistletoe, Arceuthobium abietinum f. sp. concoloris. Many branches infected with dwarf mistletoe were also infected with cytospora canker, caused by Cytospora abietis. Yellow witches' broom was also present on white fir. A high proportion of the numerous white fir stumps in the campground contained Fomes annosus conks. Annosus root rot usually acts as a root and butt rot in true firs. If root and butt decay advances faster than new roots and wood can be produced, the result can be hazardous trees or trees under stress. Other conditions in the campground which can stress trees include saturated soil near site 11 and stocking of 360 sq.ft./ac. at the west end of the campground. The result of the stresses caused by diseases and adverse stand conditions in the campground has been to allow the fir engraver, Scolytus ventralis, to kill white fir branches and tops, as well as entire trees.

White fir is probably not the best suited tree species for use at Cedar Pass campground. White fir continues to transpire at water stress levels which cause other species to shut down. This trait can be highly detrimental in a stand on the forest fringe. Water stress will be compounded by severe levels of dwarf mistletoe infection. White fir also has thin, easily damaged bark which probably accounts for the high level of mechanical injury in the campground. Mechanical injuries not only stress the tree by severing some conductive tissues, but in true firs, injuries close to the ground also have a high probability of becoming infected with Fomes annosus. Annosus root rot infections in white fir will have little effect on other tree species in the campground but will readily infect additional white fir through root contact.

All other tree species in Cedar Pass campground appear to be healthier than white fir. Because of differences in the shade tolerance of seedlings, however, only white fir is reproducing itself in the campground. In the absence of fire or active vegetation management, diseased white fir can be expected to dominate the campground and there will be chronic mortality for the forseeable future.

MANAGEMENT ALTERNATIVES

1. Do Nothing. Many white fir will be infected with dwarf mistletoe, cytospora canker and annosus root disease. The campground will retain an unsightly appearance as the fir engraver kills branches and tops of stressed trees. White fir mortality will occur periodically and require removal. Some white fir may become hazardous due to decay of roots and butts by annosus root disease. White fir regeneration will become infected with dwarf mistletoe and annosus root disease, which will perpetuate the current situation. White fir will probably become more prominent in the future as the species which are less shade tolerant die from old age or overcrowding and are not replaced.

2. Eliminate white fir from campground. Removal of all or most of the white fir in the campground would eliminate most of the current pest problems. The severe opening of the campground stand might make the area more attractive to hunters during the fall, but it is likely to cause a considerable decline in summer use. A sudden opening of the stand has the potential to cause sunscald and windthrow to the leave trees.

3. Rehabilitate the campground. Thinning the campground and adjacent areas to stocking levels of 120-150 sq.ft./ac. should produce a healthier stand which is less susceptible to fir engraver attack. Thinning should also partially compensate for the presence of dwarf mistletoe and annosus root rot in the white fir. Discriminating against white fir with decadent crowns and basal injuries could reduce the number of trees which have a high probability of being attacked by bark beetles or of becoming hazardous. Non-merchantable logs cut during thinning could be used for traffic control in the campground to reduce further mechanical injury to residual trees. Current openings as well as those created by removing pockets of diseased or defective trees could be planted with ponderosa pine grown from a local seed source. This should decrease future pest problems because it will increase the diversity in the campground, which usually makes an ecosystem less prone to disruption. It will also revegetate the openings with trees which are not susceptible to the current disease problems and which are better adapted to the climatic fluctuations likely to occur over long periods of time. The use of borax on all freshly cut conifer stumps as required by FSM 2331.33 R-5 Supplement No. 90 will prevent most new Fomes annosus infections but will not affect existing infection centers.

PLUM VALLEY CAMPGROUND
OBSERVATIONS AND DISCUSSION

Plum Valley Campground is located 3 miles east of the town of Davis Creek and U.S. 395. The 14 unit campground is adjacent to the South Fork of Davis Creek.

The campground vegetation is essentially a single-storied ponderosa pine stand. There are a few old pre-dominant ponderosa pine, but the majority of the dominants are about 115-years-old. Some white fir exists along the creek. White fir seedlings are invading the campground but there is little other understory vegetation.

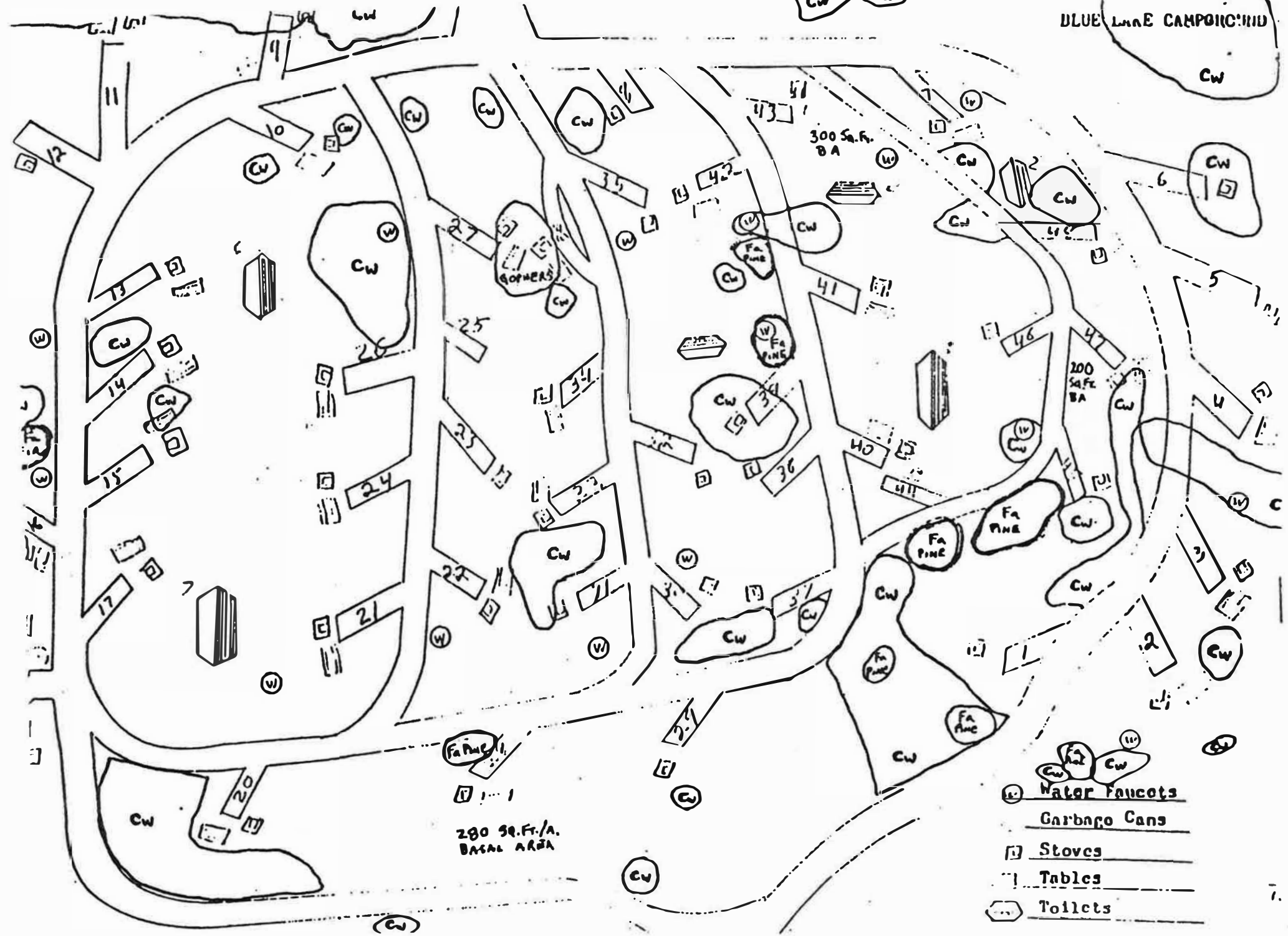
No current pest problems were observed inside the campground limits. Several ponderosa pine immediately adjacent to the campground had been recently attacked by the mountain pine beetle. Pines in the area are probably fairly susceptible to bark beetle attack because there is a high level of stocking on a low quality site. The campground is a site 70 Meyer. The Silvicultural Practices Handbook lists a desired basal area of about 140 sq.ft./ac. based on the age of the dominants. Basal areas in the campground range from 180 to 300 sq.ft./ac. These levels are generally in excess of what the site is capable of supporting over long periods of time. The basal area will increase with time until competition causes the trees to be extremely susceptible to attack by mountain pine beetle. Bark beetle attacks will reduce the basal area but because the mortality is likely to occur in groups, the results will probably not be compatible with campground management objectives. Thinning in, and around, the campground would increase the resistance of the residual trees to bark beetle attack. It would also give more control over the future composition and distribution of the campground vegetation.

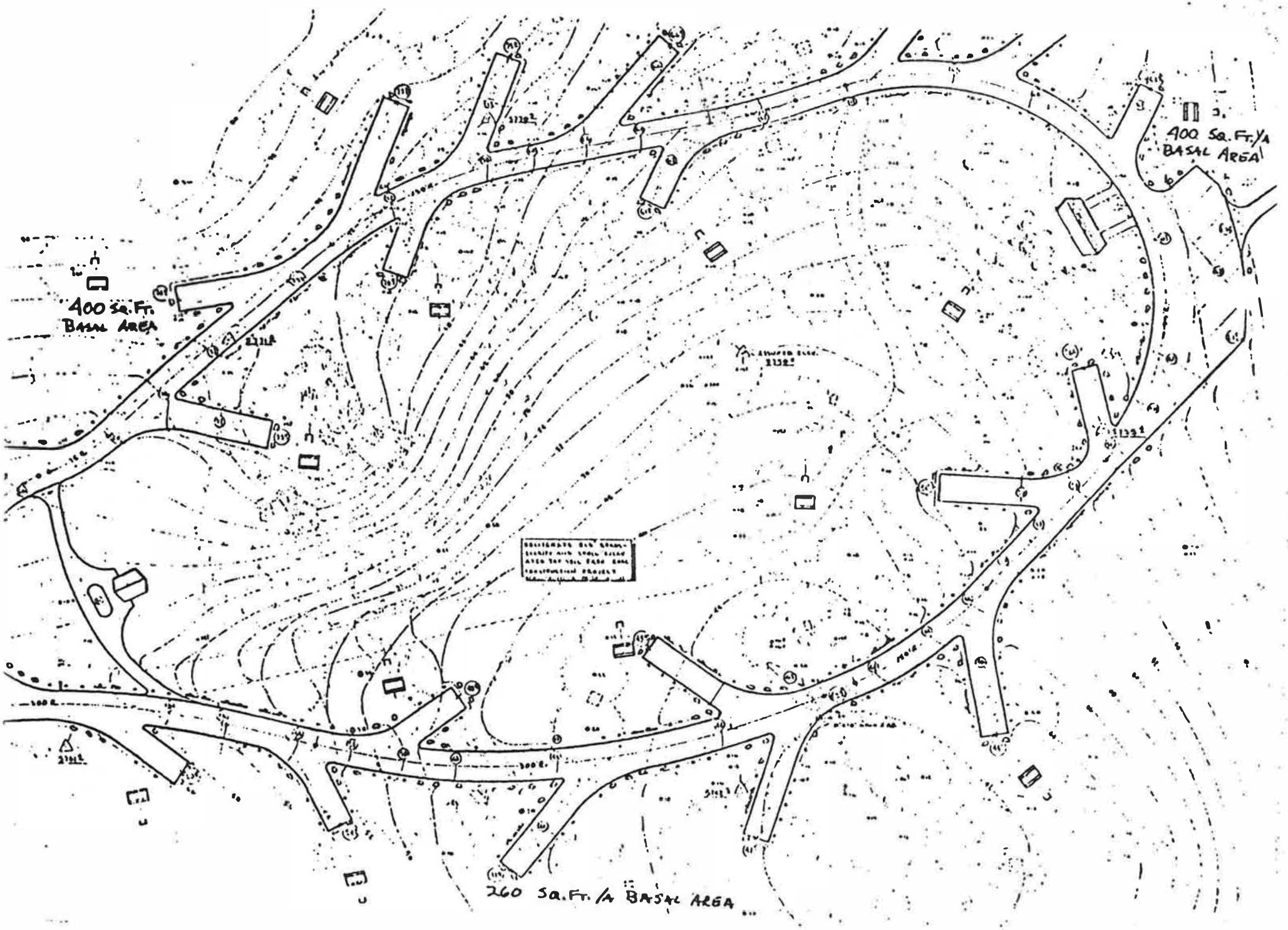
MANAGEMENT ALTERNATIVES

1. Do Nothing. The basal area will continue to increase with time. The trees will become increasingly susceptible to bark beetle attack. At some future point, possibly in conjunction with drought or stand disturbance, bark beetles will cause mortality in the campground. Because most of the stand is a single species and age and also the mountain pine beetle has an aggregating pheromone, the mortality is likely to involve groups of trees.

2. Thin campground and adjacent areas. A reduction of the basal area should increase tree vigor and decrease susceptibility to bark beetles. Because some portions of the campground are currently over twice desired stocking levels, it would be appropriate to reduce the basal area through two or more entries separated by at least two years to allow the leave trees to recover. It may be wise to consider culturing some replacement trees because most of the campground trees are over 100 years old and their expected lifespan may not be extremely long on a low quality site. Although white fir seedlings are surviving under the protection of the campground overstory, those which are not adjacent to the creek should not be expected to remain thrifty if their crowns reach the overstory. All conifer stumps cut during thinning should be treated with borax to prevent infection by Fomes annosus. Green pine slash created during thinning could present a hazard to the residual stand if pine engravers, Ips spp., build up in it. Thinning scheduled from mid-July through December would have the lowest risk of a pine engraver buildup in the slash. If thinning is scheduled for other times of the year to avoid recreational conflicts or if additional measures seem

warranted to protect the campground at any time of year, the slash could be modified to prevent pine engraver breeding by chipping or burning within a month after cutting. Because the campground is reasonably close to the edge of the pine type, it may be feasible to protect the campground by hauling the slash at least one-quarter mile into the juniper woodland type.


BLUE LAKE CAMPGROUND
300 Sq.Ft. BA
200 Sq.Ft. BA
280 SQ.FT./A. BASAL AREA
GOPHERS
Fa PINE
CW
W
Water Faucets
Garbage Cans
Stoves
Tables
Toilets


MILL CREEK CAMP ROUND
400 Sq. Ft. BASAL AREA
400 Sq. Ft./A BASAL AREA
260 Sq. Ft./A BASAL AREA

CEDAR PASS CAMPGROUND